



HIRI NEWS



HEAT ISLAND REDUCTION
INITIATIVE

The Connection Between Urban Heat Islands and Human Comfort, UHI's and Sprawl in New Jersey, The New York Ecological Infrastructure Study, and more!

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Using the OUTCOMES Model to Assess Human Comfort

Our first speaker was Dr. Gordon Heisler of the USDA Forest Service who presented his research on UHI's and human comfort. Specifically, he focused on a new model called

OUTCOMES, which analyzes urban forest effects on human thermal comfort. OUTCOMES stands for Outdoor Human Comfort Expert System. The software, which can be downloaded for free at <http://www.fs.fed.us/ne/syracuse/>, is a Windows-based application that predicts human thermal comfort levels in the presence of varied landscape elements like trees, buildings, grass, and concrete surfaces.

The model undertakes calculations based on the following assumptions: (1) the index of comfort is given by the modeled energy budget of a person, (2) a person is modeled as a vertical cylinder, and (3) the sky is always clear. The comfort index is based on an energy budget calculation for a person, where: $EB = M + S + T_a - C - E - T_e$, and

EB = energy budget (storage)
M = metabolism
S = Shortwave absorbed
 T_a = thermal radiation absorbed
C = convective heat transfer from body
E = evaporation
 T_e = Thermal radiation emitted

Users select a city and enter data related to time, weather, the clothing and activity of a person, dimensions and species of trees, and related factors.

Dr. Heisler noted that the program has an easy-to-use graphical user interface to facilitate data entry. He said that a visual design component can be used to display the elevation view of a tree, a plan view of the tree crown outline and its shadow, and to determine if a person somewhere near the tree would be in the tree's shade.

Next, Dr. Heisler touched briefly on the capabilities of OUTCOMES. One is that calculated solar radiation can be

adjusted for pollution effects by choosing "air pollution" from a menu that includes "very clean," "fairly polluted," and "very polluted" options. OUTCOMES considers one person, one tree, and one instant in time for each run. The person is modeled as a vertical cylinder within a sphere in which the sun is blocked by a tree or solid object.

Dr. Heisler also stated that OUTCOMES has the ability to extrapolate weather data from an airport site to neighborhoods in the vicinity. Modifications to airport temperature and humidity may be predicted for sites in a small woodland, a dense residential area with large trees, or a "downtown" site. The equations for this extrapolation were derived for summer conditions in Atlanta, and may not apply to other cities, climates, or times of the year.

Modifications to wind speed are given based on "cover density," which is the estimated percentage of an area in the upwind direction to about 300 m (1000 ft) that is covered by trees and buildings. Wind reductions by very close buildings, walls, or trees would likely be greater than the reductions calculated from cover density. Average weather data sets for different cities may be included in a future version of OUTCOMES, but are not included in this version.

Using Visual Design, opened from the Main OUTCOMES window, users can specify the dimensions of a tree, which gives the side view and top view of the tree-crown outline, its shadow, the location of a person, and the distance and direction of the person from the tree. The tree crown shape is assumed to be an ellipsoid. Rectangle and oval shapes on the ground plane may be created in the Visual Design top view to see how a tree would shade structures such as a deck, patio, or swimming pool with a rectangular or oval shape.

Dr. Heisler said that future model development and improvements could include tests of microclimate models, the addition of multiple trees and building capability in Visual Design, more flexibility for users, a 3-D tree shading model, and the inclusion of UV irradiance models to predict UV exposure of pedestrians.

The software is being developed with the Northeastern Research Station and the State University of New York. It is funded primarily through the USDA Forest Service.

UHI and its Connection to Sprawl in New Jersey

Dr. William Solecki of Montclair State University joined the call to talk about the research he is doing with NASA's Cynthia Rosenzweig. The title of his presentation was, "The Urban Heat Island Effect and Mitigation Strategies – Connections to Sprawl."

Dr. Solecki began with a background discussion of heat islands and their impacts, as well as the methodology employed in their work. The team used meteorological station data, Landsat 5 Thematic satellite images, and global climate models (GCMs) to reach the following preliminary conclusions:

- There is a clearly identifiable UHI apparent in both the climate data and satellite images.

- Surface temperatures in Newark are on average 10.6°F higher than suburban surface temperatures in the summer and 0.36°F higher than suburban surface temperatures in the winter.

- Mean air temperatures in Newark are on average 2.9°F higher than mean suburban air temperatures.

- There is a strong annual profile in the magnitude of the urban heat

island effect with a peak in October. The monthly profile is well-correlated to monthly differences in windspeed and cloud cover.

Dr. Solecki noted his team's results need to be considered within the context of local changes in climate and land use. Using meteorological and satellite data, the researchers predict changes in air temperature and air quality over time. Key results suggest that:

- Mean air temperatures in and around Camden are expected to increase by 3.1–5.2°F in the next 50 years. Reductions in wind speed will increase the UHI at the study sites.

- The air quality problems Camden already experiences are likely to be enhanced by interactions between climate change-related warming temperatures and the UHI effect.

- The climate of the Camden region has been warming at a faster rate than the rest of their region. In Camden, suburbs have been warming faster than rural areas.

Using the SLEUTH model to evaluate land use change and urban growth out to 2050, the researchers then evaluated UHI mitigation strategies such as increasing tree cover and the penetration of light-colored roofs.

This analysis reached the following conclusions:

- There is great potential in Newark and Camden to reduce cooling energy cost from the implementation of mitigation strategies. A 10% decrease in cooling energy cost, an average for the three sites for the moderate 2020 scenario, could save Newark \$725,000 annually.

- The benefits provided by urban trees increase over time. As the trees mature, their canopy shades a larger area directly reducing energy demand and cost.

However, Dr. Solecki pointed out that carbon sequestration potential from urban tree planting is limited in comparison to other capture strategies.

A primary conclusion to date is that UHI's have proliferated in the study area as land development has taken place. Furthermore, projected trends in suburban and exurban sprawl illustrate that the UHI will continue to spread spatially into the future. Dr. Solecki suggested that, to counter these trends, NJ state agencies might integrate mitigation strategies into current operations and planning.

Dr. Solecki's presentation can be accessed at:
<http://www.csam.montclair.edu/earth/eesweb/solecki/june24.ppt>

NY Ecological Infrastructure Study

Colin Cheney, Director of the Earth Pledge Green Roofs Initiative, spoke next about a study evaluating "ecological infrastructure" in New York City (NYC). The purpose is to support the development of green roofs as a central strategy of a comprehensive urban "ecological infrastructure." Functionally, green roofs fit the mandate for sustainable urbanism by reducing stormwater runoff, UHI's, and regional warming due to global climate change.

Colin said the study's scope also includes an investigation of the impacts, costs and benefits of expanding green roof infrastructure and related ecological practices. During Phase 1, which begins in September 2003, Colin's research team will:

- Conduct initial research and data collection, and provide policy makers with arguments in favor of government support for green roofs.

- Develop an ecologically sound and cost effective strategy for using green roofs to address urban environmental and human health problems in NYC.

The study will provide policy makers with a set of scientific analyses and balanced benefit and cost information to determine the rationale for, and the proper means of, supporting green roofs and related measures.

Phase 2, which extends from September 2004 to September 2006, addresses important longer term tasks. These include: (1) Refinement and dissemination of green roof testing protocols in NYC, (2) Implementation of NASA/GISS pilot site, (3) Development of modeling scenarios including technologies like high-albedo roofing, urban forestry, stormwater retention tanks, downspout disconnects, and vegetated swales, and (4) Refined cost-benefit analysis.

Next, Colin talked generally about the Earth Pledge Green Roofs Initiative and its three-pronged strategy of research, education, and implementation. One recent development in support of this strategy is the formation of a Green Roofs Policy Task Force, which convenes policy-makers and city agencies to explore green roof policy options, advise ongoing research and develop pilot projects around the city. Participants include EPA Region 2, the Mayor's Office of Environmental Coordination, and the USDA Forest Service.

Two upcoming products from Earth Pledge are a symposium for the real estate and corporate community (September '03), and a

full color, 200-page Green Roof Sourcebook to showcase the use of green roofs for urban ecological restoration in cities around the world.

For more information about the Earth Pledge Green Roofs Initiative, see:
<http://www.earthpledge.org/GreenRoof.html>

ICLEI Cities for Climate Protection Training Workshop in Denver

Ryan Bell joined the call to talk about ICLEI's Cities for Climate Protection 10th National Training Workshop in Denver, CO, from May 28-31, 2003. The workshop's title was "Climate Protection Community of the Future: Components of Long-term Success."

Bell stated that the meeting included numerous sessions on topics relevant to UHI mitigation. For instance, a session called "Using Urban Design to Create Clean, Cool, Livable Communities" featured a presentation by Jim Simpson, Director of Environmental Analysis at the USFS' Center for Urban Forest Research. His plenary talk was titled, "Urban Forests: Saving Energy and Improving Air Quality."

Another breakout training program, "Urban Form In-Depth", featured a Session called "Cooling the Urban Heat Island." Presentations were made by Niko Dietsch (EPA), Ben Taube (City of Atlanta), Vinnie Hunt (City of Tucson), Gary Gero (City of Los Angeles), and David Schultz, (Philadelphia's Energy Coordinating Agency).

Conference presentations can be viewed and downloaded from ICLEI's website:
http://www.iclei.org/us/ccp/denver_presentations/

Cool Roof Demonstration in Baltimore

David Brosch, of Baltimore's Department of Housing and Community Development Weatherization Assistance Program, led a Cool Roof Demonstration Program Workshop on June 27th. The purpose was to convene a series of presentations and a demonstration highlighting the city's pilot Cool Roof Program to promote elastomeric reflective roofing systems.

David said that the weatherization program is currently piloting the cool-roof system at 14 rowhouses, and there are plans to do 14 more. The program, which focuses primarily on helping low-income families complete energy efficiency repairs they couldn't otherwise afford, has no firm commitment beyond this point. David says that, either way, the cool roof demonstration is consistent with the program's mission of saving homeowners energy and money.

In a recent Baltimore Sun article, David said: "[The cool roof pilot] could make a real difference for people who don't have a lot of disposable income. And that's the clientele that we are serving here."

The Baltimore cool roof demonstration is modeled after the Cool Homes program in Philadelphia, another city with a large percentage of flat-roofed homes. In the Philadelphia program, workers apply an acrylic coating over existing roofs. Similarly, a Philadelphia company, Roof Menders Inc., was hired to apply a meshlike underlay for extra waterproofing under the acrylic material.

Brosch told the Sun that it might be several years before cool roofs are widely used in Baltimore, if it happens at all. This is because so little is known about the roof benefits, and because his agency

would have to attract additional funding to offer it to weatherization program clients. In addition, other city officials need to be convinced that the system is worthwhile, Brosch said.

Rooftop Garden Conference in Chicago

Eva Wong, EPA, talked about the Greening Rooftops for Sustainable Communities Conference in Chicago May 28-30, 2003. More than 500 people attended, which is far more than the 300 participants the conference steering committee anticipated. Over 30 papers were presented in three conference tracks: (1) Policy and Programs for Market Development; (2) Design Techniques and Case Studies; and (3) Research on Technical Performance and Benefits. The exhibits and posters attracted a lot of attention, and the first annual green roof awards event was held. Eva noted that overall, the conference was a great success, and planning for the 2004 conference in Portland has already begun.

More information regarding the conference can be found at:
<http://www.greenroofs.ca/grhcc/conference.htm>. Further, the Proceedings are available at:
<http://www.greenroofs.ca/grhcc/cd.htm>

The next conference call is TBD. Stay tuned for the date, call-in number, and access code.